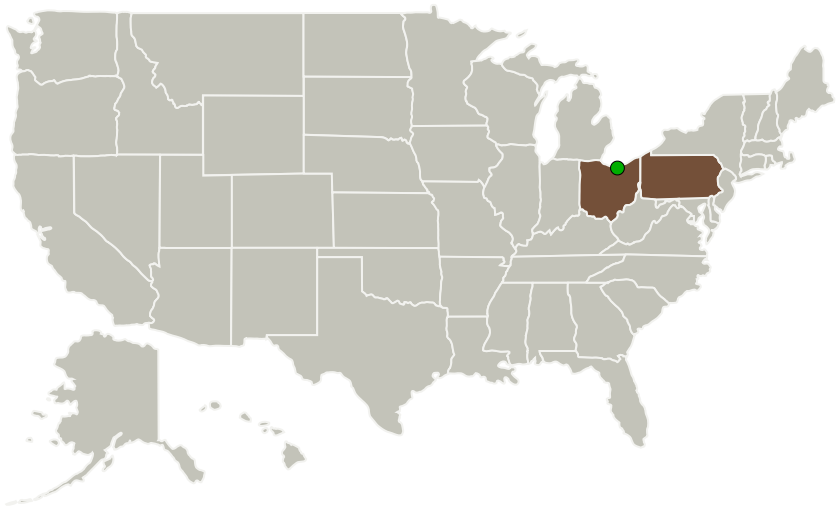
GaN-Based High Power High Frequency Wide Range LLC Resonant Converter, Phase I

Completed Technology Project (2017 - 2017)

Project Introduction

SET Group will design, build and demonstrate a Gallium Nitride (GaN) based High Power High Frequency Wide Range LLC Resonant Converter capable of handling high power and high frequency operation. The GaN LLC Converter will operate at 1 MHz with an input voltage of 80V - 300V and output of 300V - 2kV, capable of handling up to 1 kW. The GaN LLC Converter will have an approximate size of 4in x 2in x 0.5in. Current technology utilizes silicon-based solutions for power conversion and distribution. GaN can fundamentally perform well beyond current silicon based hardware. GaN has direct benefits such as higher power density, reduced footprint, increased power capacity, and improved power efficiency. Increasing frequency of operation results in smaller components but it also creates a challenge for thermal management and magnetic component design. The proposed work will include a matrix transformer which offers: low profile, high power density, robust and flexible for shock and vibration handling, and superior electrical characteristics. In addition, the wide range capability will be handled thanks to the LLC topology which offers: wide input range, ZVS operation, low turn-off current. Finally, the GaN-LLC Converter will make use of additive manufacturing for its thermal management. The marriage of GaN, LLC, matrix transformer design, and additive manufacturing results in a design that is smaller, more efficient and more cost-effective than Si-based products. SET Group will design the GaN-LLC Converter to be used in PPUs, but the outcome of this work will help as a platform for other power conversion products utilizing GaN technology to be developed.

Primary U.S. Work Locations and Key Partners



GaN-based High Power High Frequency Wide Range LLC Resonant Converter, Phase I Briefing Chart Image

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Organizations Performing Work	Role	Type	Location
SET Group, LLC	Lead Organization	Industry Small Disadvantaged Business (SDB)	
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Pennsylvania

Images

Briefing Chart Image
GaN-based High Power High Frequency Wide Range LLC Resonant Converter, Phase I Briefing Chart Image *(https://techport.nasa.gov/image/130443)*

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
SET Group, LLC

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

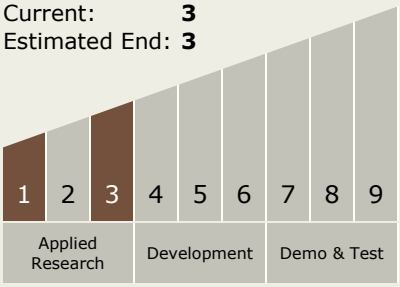
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Raul Chinga Alvarado

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



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Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.3 Power Management and Distribution
    - TX03.3.1 Management and Control